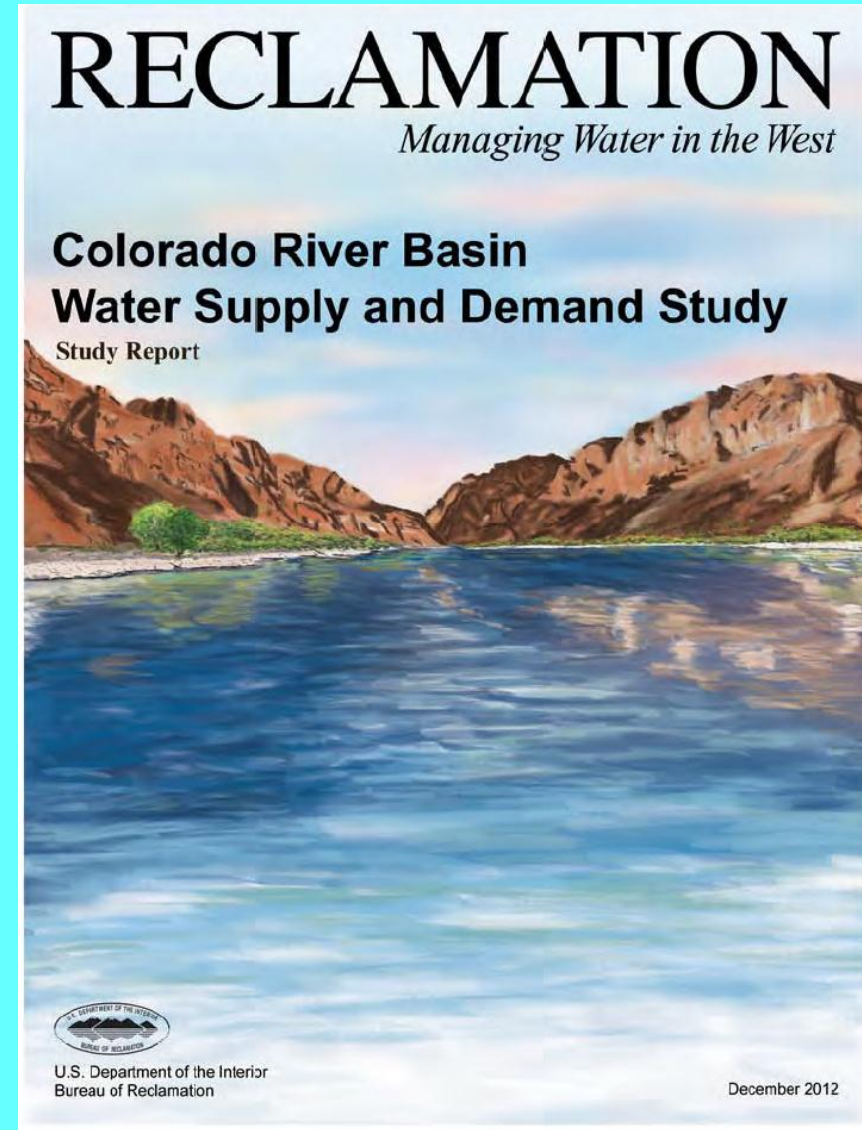


Colorado River Basin Water Supply and Demand Study ("Basin Study") Update

Phoenix AMA Groundwater
Users Advisory Council
November 14, 2013



Presentation Overview

- ❖ Summary of Basin Study
- ❖ Next Steps



Colorado River Water Supply and Demand Study

Objectives of the Study

- Assess current and future imbalances in water supply and demand for the period 2010 to 2060.
- Assess the system reliability and risks to all Basin Resources (water supply, hydropower, water quality, fish and wildlife, flood control, recreation).
- Develop and evaluate opportunities/strategies for resolving imbalances.

Study Participants

- United States Bureau of Reclamation
- Seven Colorado River Basin States: Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming
- Tribal Interests
- Other Interested Groups (NGOs, Public Interest)
- Public Input at selected phases of the Study



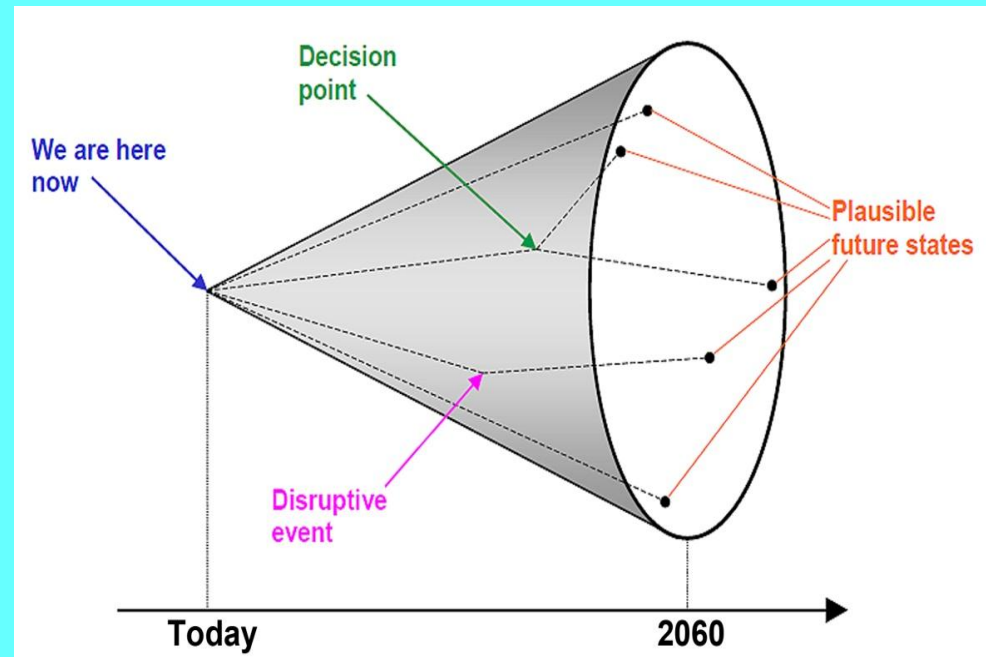
Colorado River Basin Water Supply and Demand Study

- ❖ Colorado River Basin – covers an area of over 252,000 square miles.
- ❖ Supplies water to over 30 million people and for irrigation of nearly 4 million acres.
- ❖ Flows are highly variable from year to year: 5.4 million (1977) acre-feet (MAF) to 24.3 MAF (1984).
- ❖ **Future supplies and demands are uncertain.**



Addressing an Uncertain Future

- ❖ The path of major influences on the Colorado River system is uncertain and can not be represented by a single view.
- ❖ An infinite number of plausible futures exist.
- ❖ A manageable and informative number of scenarios - water supply and water demand - were developed to explore the broad range of futures.



(adapted from Timpe and Scheepers, 2003)

Colorado River Basin Water Supply and Demand Study

Water Supply Scenarios

Observed Resampled:

- future hydrologic trends and variability will be similar to the past 100 years

Paleo Resampled:

- future hydrologic trends and variability are represented by the distant past (approximately 1250 years)

Paleo Conditioned:

- future hydrologic trends and variability are represented by a blend of the wet dry states of the paleo-climate record but magnitudes are more similar to the observed period

Downscaled GCM Projected:

- future climate will continue to warm with regional precipitation trends represented through an ensemble of future GCM projections

Water Demand Scenarios

Current Projected (A):

- growth, development patterns, and institutions continue along recent trends

Slow Growth (B):

- low growth with emphasis on economic efficiency

Rapid Growth (C1 and C2):

- economic resurgence (population and energy) and current preferences toward human and environmental values
 - C1 – slower technology adoption
 - C2 – rapid technology adoption

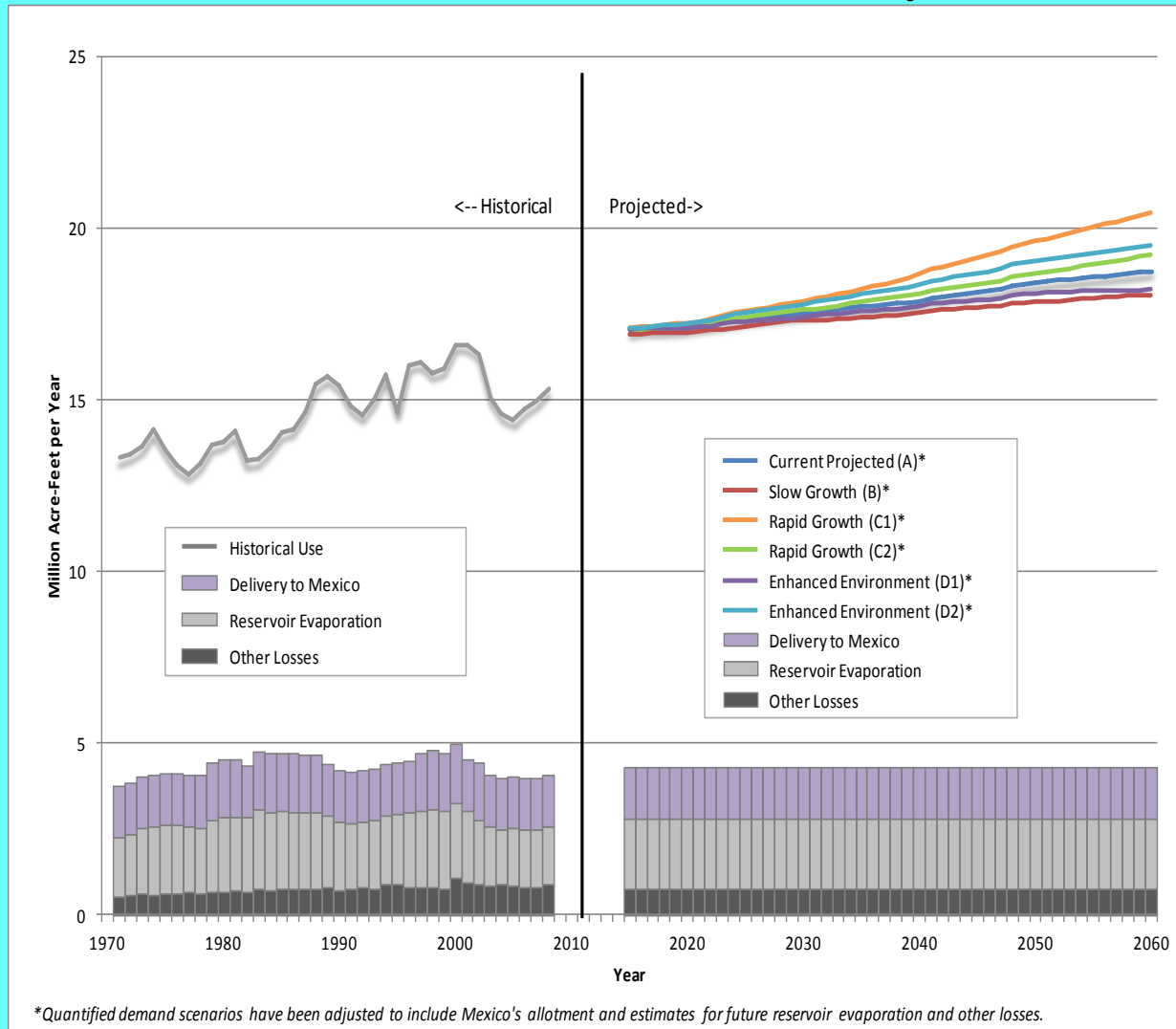
Enhanced Environment (D1 and D2):

- expanded environmental awareness and stewardship with growing economy
 - D1 – with moderate population growth
 - D2 – with rapid population growth

Colorado River Basin Water Supply and Demand Study

Water Demand Scenarios Summary

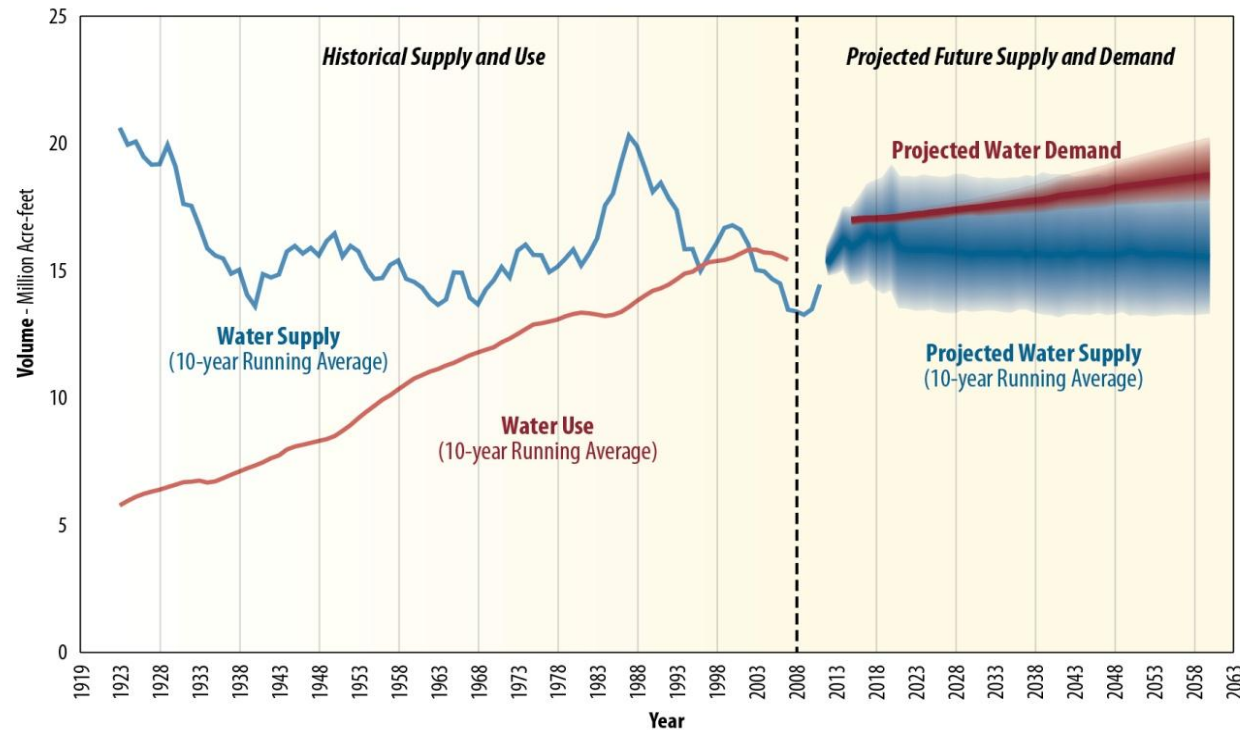
Colorado River Basin Historical Use and Future Projected Demand



- ❖ Demand for consumptive uses ranges between 13.8 and 16.2 maf by 2060 (including Mexico and losses 18.1 and 20.4 maf by 2060)
- ❖ Approximately a 20% spread between the lowest (Slow Growth) and highest (Rapid Growth – C1) demand scenarios

Projected Future Colorado River Basin Water Supply and Demand

- ❖ Median supply-demand imbalances by 2060 are approximately 3.2 million acre-feet (MAF)
- ❖ Arizona portion of imbalance is about 1 MAF
- ❖ This imbalance may be more or less depending on the nature of the particular supply and demand scenario
- ❖ Imbalances have occurred in the past, but deliveries have been met due to reservoir storage



Notes:

Water Supply represents natural flow as measured at the Colorado River above Imperial Dam, Arizona

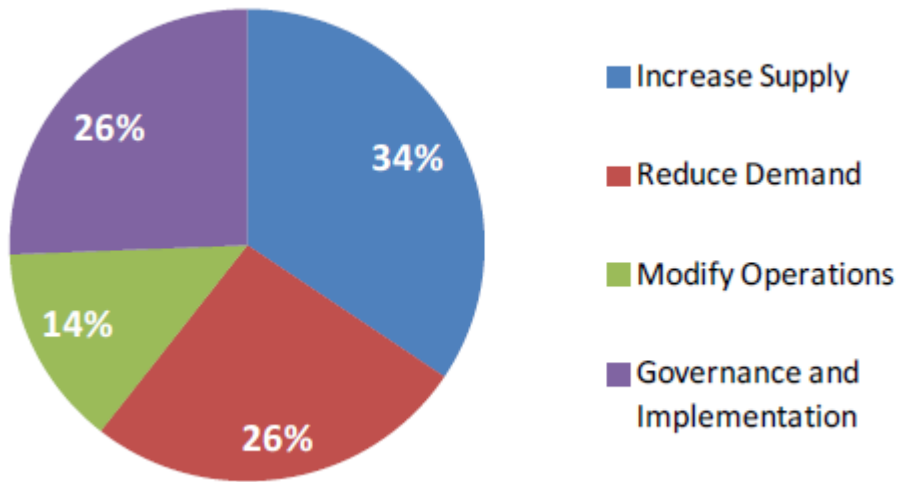
Water Use and Demand include deliveries to Mexico in accordance with the 1944 Treaty with Mexico and losses such as those due to reservoir evaporation, native vegetation, and operational inefficiencies.

Projected Water Supply is computed as the average 10th, 50th (median), and 90th percentiles of the Study's 4 water supply scenarios. The average of the medians is indicated by the darker shading.

Projected Water Demand is represented by the Study's 6 water demand scenarios. The median of the scenarios is indicated by the darker shading.

Options Summary

- Over 150 options were submitted to the Study from November 2011 to February 2012



Increase Supply – importation, reuse, desalination, etc.

Reduce Demand – M&I and agricultural conservation, etc.

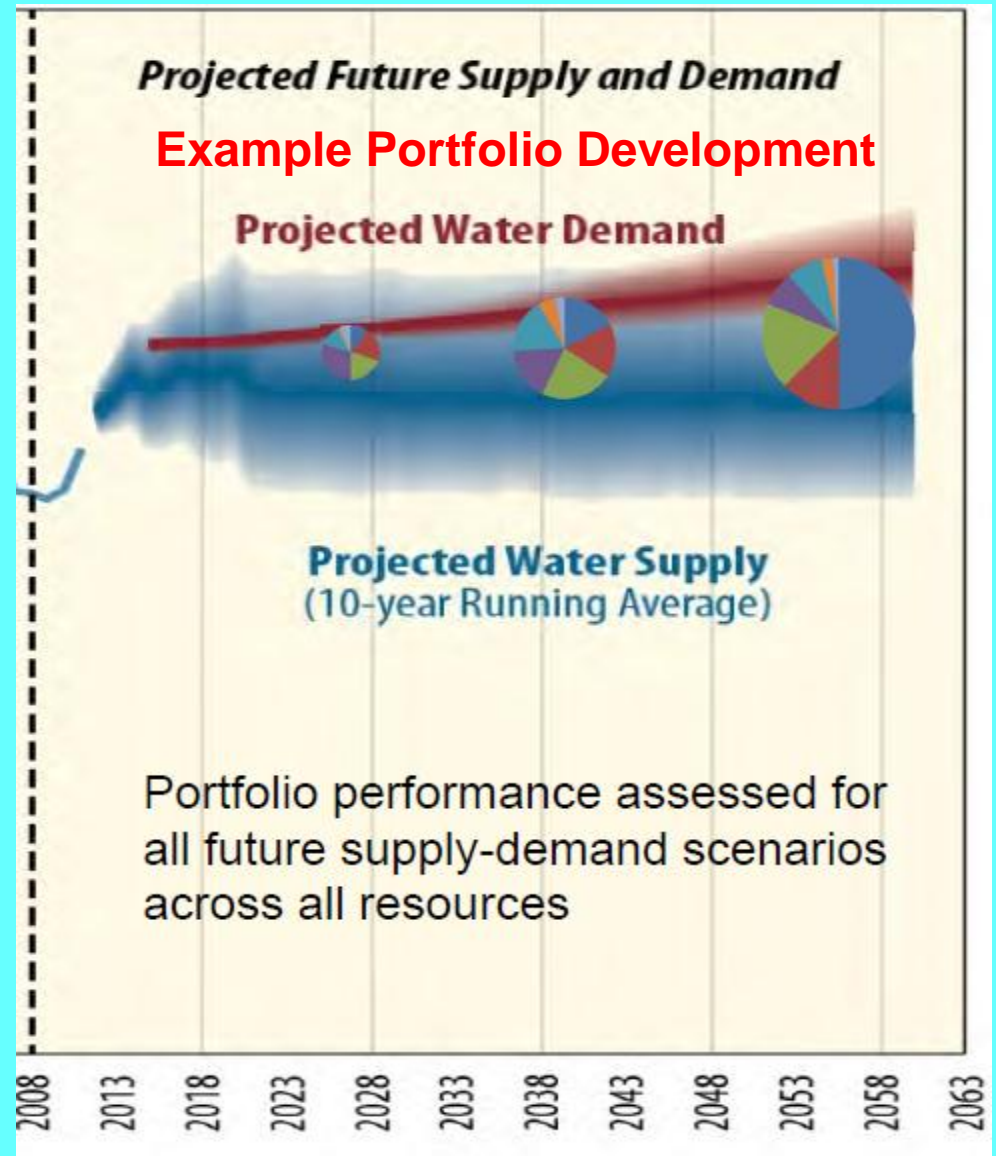
Modify Operations – transfers & exchanges, water banking, etc.

Governance & Implementation – stakeholder committees, population control, re-allocation, etc.

Colorado River Basin Water Supply and Demand Study

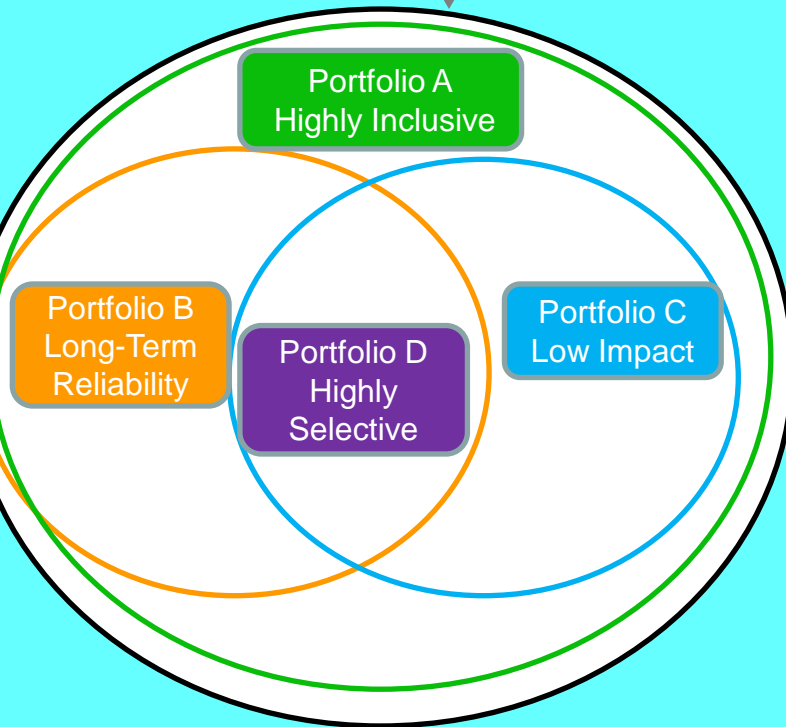
Portfolio Development

- ❖ “Portfolios” are combinations of options that implement a particular strategy
- ❖ Strategy expressed through characterization criteria which determines how options are combined
- ❖ Four portfolios developed to demonstrate potential ways options could be combined



Portfolio Development

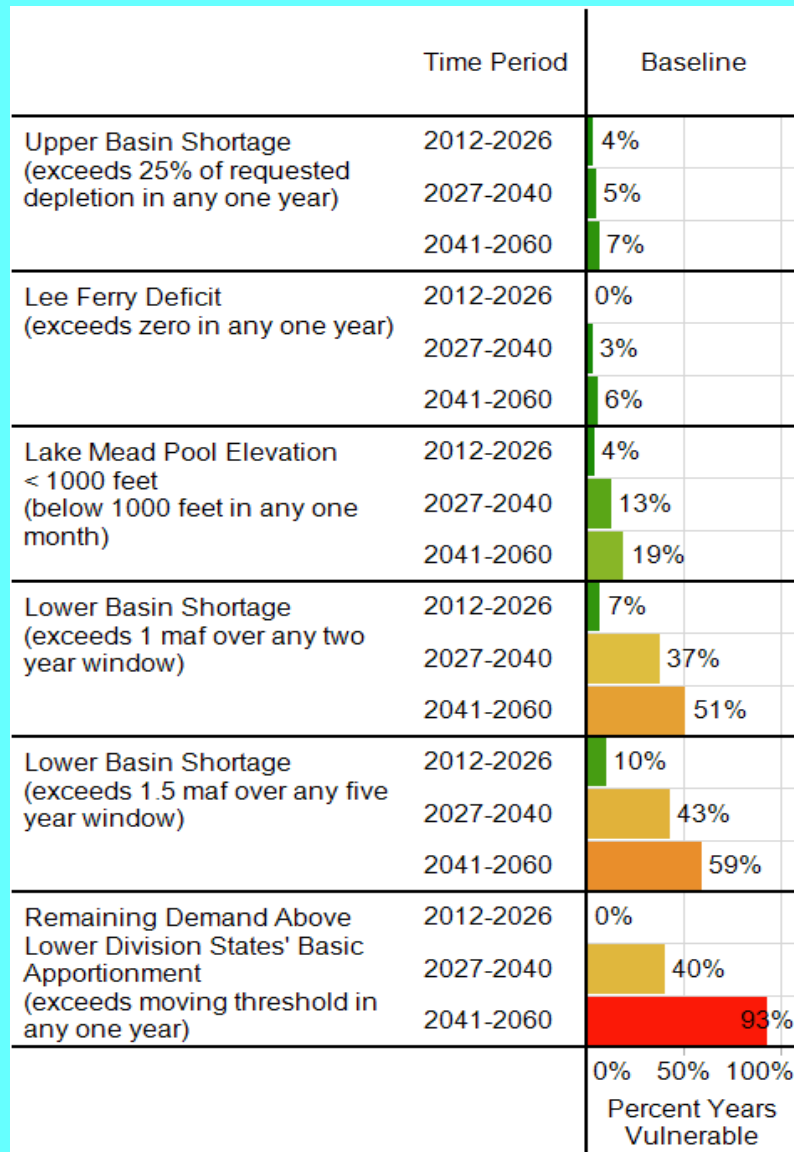
Universe of options
considered



Portfolio	Which Options?
Portfolio A Highly Inclusive <i>Ordered by least-cost, but higher risk strategy</i>	<ul style="list-style-type: none"> • Most cost effective • Highly inclusive set of option preferences • Considers the <u>largest set</u> of options
Portfolio B Long-Term Reliability <i>High feasibility and long-term reliability</i>	<ul style="list-style-type: none"> • Low risk strategy in the long-term with high reliability • High technical feasibility • Excludes options with high permitting, legal, and policy risks
Portfolio C Low Impact <i>Low environmental impact</i>	<ul style="list-style-type: none"> • Prioritizes options that have low environmental impacts and long-term flexibility • Excludes options with high permitting risk
Portfolio D Highly Selective <i>An intersection of high feasibility, high long-term reliability, and low environmental impact</i>	<ul style="list-style-type: none"> • High technical feasibility and long-term reliability • Low energy intensity • Excludes options with high permitting, legal, and policy risks • Considers <u>smallest set</u> of options

Water Delivery Indicator Metrics

Vulnerable Years



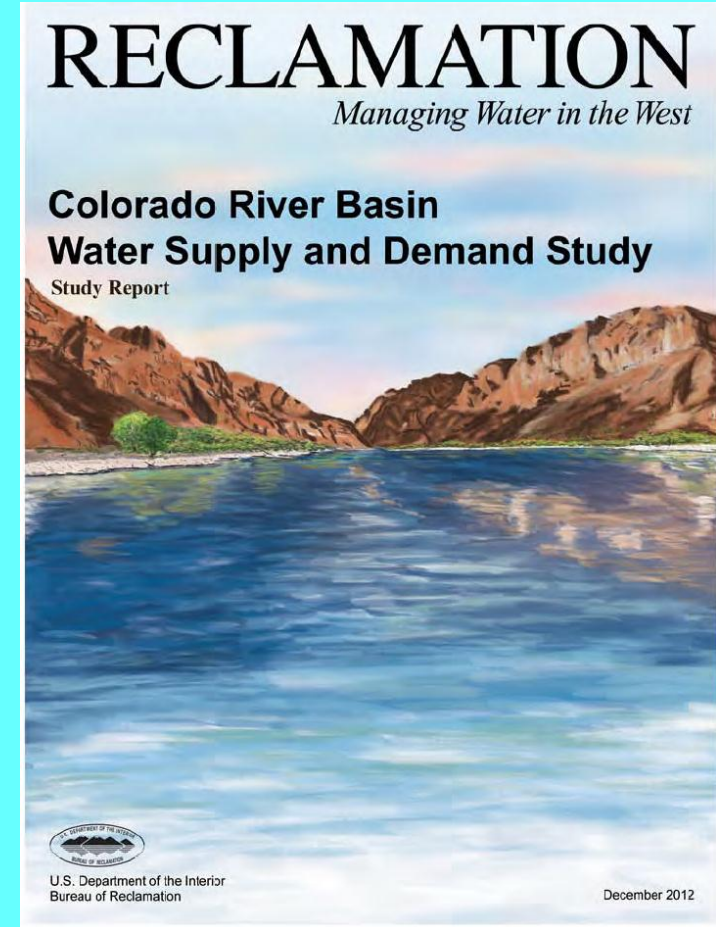
Colorado River Basin Study Water Supply and Demand Study

Summary

- ❖ **The system is vulnerable if nothing is done.**
- ❖ **Taking action greatly reduces vulnerability and makes the system more resilient to adverse conditions, but does not entirely eliminate vulnerability**
- ❖ **Vulnerabilities are most pronounced under GCM-projected conditions, but exist under all supply/demand conditions.**
- ❖ **Reductions in vulnerabilities are small in early period (through 2026), but sizable reductions occur in later periods as more options become available.**
- ❖ **Options demonstrate improvements for all resource categories, but not all vulnerabilities are eliminated.**
- ❖ **4 portfolios explore different approaches toward addressing imbalances; annual costs range from \$3.5 B to \$4.5 B through 2060.**

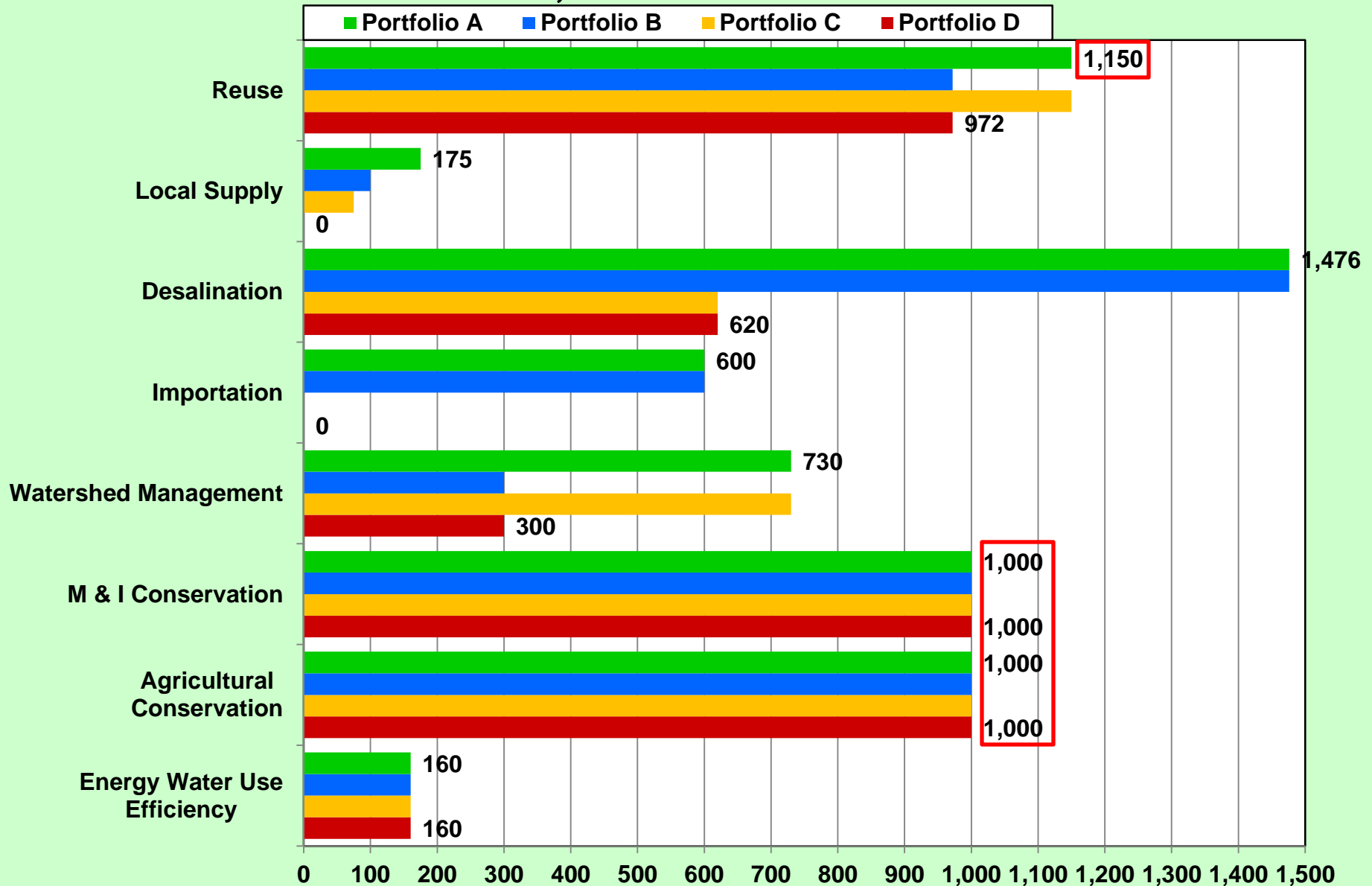
Next Steps

- ❖ Next Steps (Moving Forward) process started in May 2013
- ❖ Reduce Uncertainties Related to:
 - Water Conservation
 - Water Reuse
 - Water Banking
 - Water Transfers
 - Weather Modification
 - Supply Augmentation
 - Work groups have been created to address the above items
- ❖ Further Study of Tribal Water Uses and Issues
- ❖ Advance science and modeling tools used in the Study
- ❖ Consider strategies that provide a wide-range of benefits to all water users

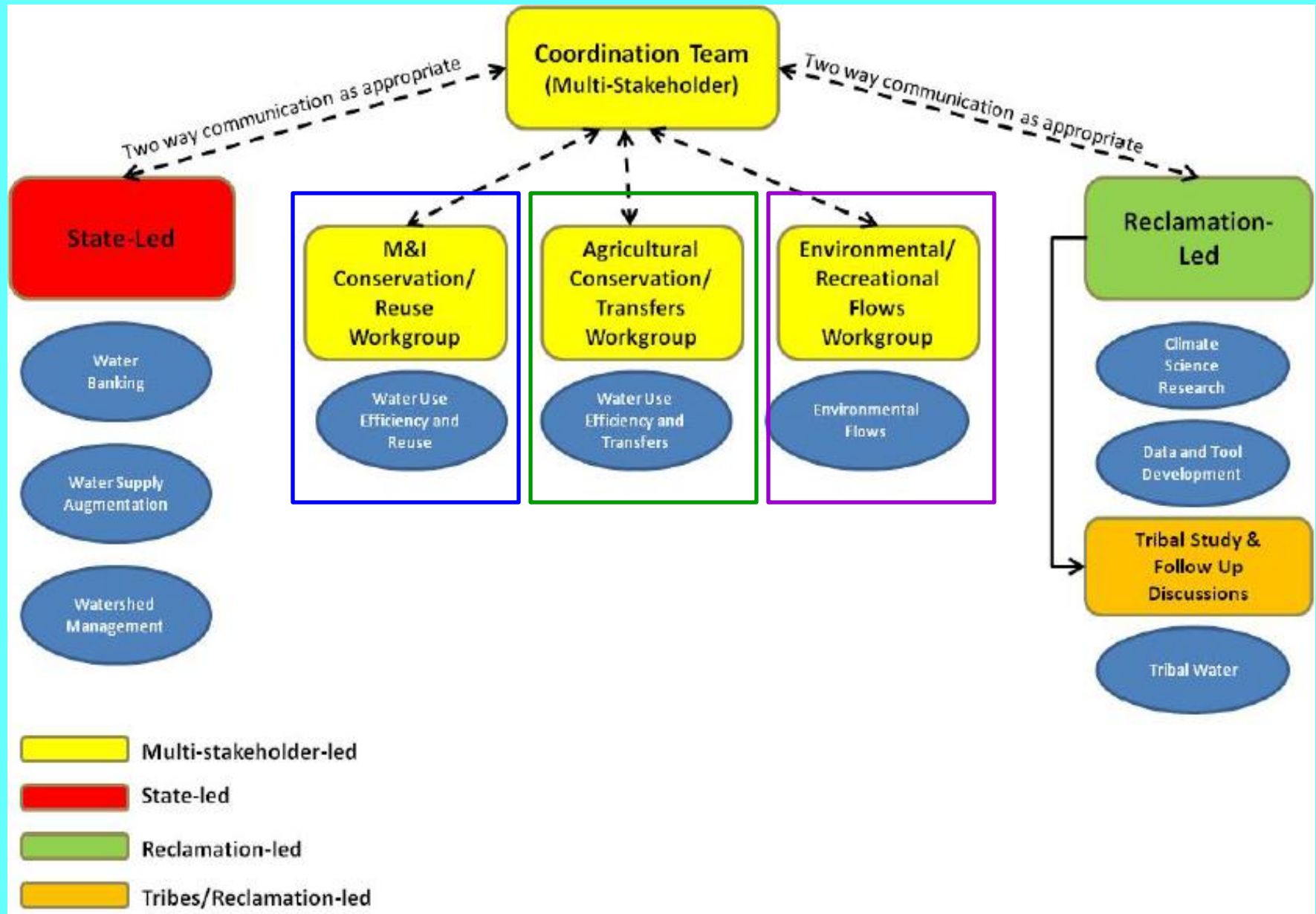


Portfolio Options and Estimated Volumes

1,000s Acre-feet



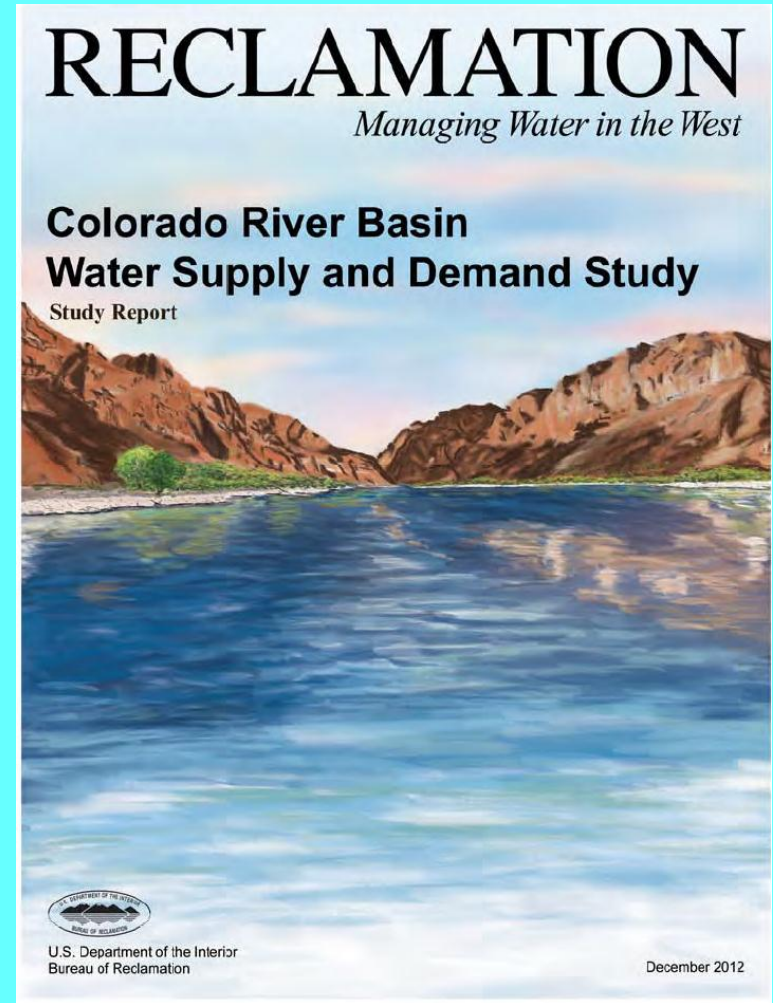
Next Steps



Colorado River Basin Water Supply and Demand Study

What the Study Is and Is Not

- ❖ The Basin Study is a planning effort that utilizes a scenario approach to develop projections of supply and demand to estimate projected imbalances in the Colorado River Basin.
- ❖ The Basin Study identifies options and strategies that have the potential to mitigate the projected imbalances.
- ❖ ***The Basin Study is a call to action.***
- ❖ The Basin Study does not make any recommendations regarding programs or projects.



Basin Study Reports

❖ The Final Basin Study is a collection of nine reports

Executive Summary

Final Study Report

Technical Report A – Scenario Development

Technical Report B – Water Supply Assessment

Technical Report C – Water Demand Assessment

Technical Report D – System Reliability Metrics

Technical Report E – Approach to Develop and Evaluate Opportunities to Balance Supply

Technical Report F – Development of Options and Strategies

Technical Report G– System Reliability Analysis and Evaluation of Options and Strategies

RECLAMATION
Managing Water in the West

**Colorado River Basin
Water Supply and Demand Study**
Study Report

RECLAMATION
Managing Water in the West

**Colorado River Basin
Water Supply and Demand Study**
Technical Report A—Scenario Development

RECLAMATION
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**Colorado River Basin
Water Supply and Demand Study**
Technical Report E—Approach to Develop and Evaluate
Options and Strategies

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Executive Summary